

Transforming domain knowledge: a systemic view at the school curriculum

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What happens to domain knowledge on its way into the school curriculum? The article explores this question from a systems view of the knowledge transformation process. This process is not only bound to *contextual knowledge* about *social forces* but also to the school's own *educational knowledge* framework. Further, utilizing knowledge depends on images of *learning* and *learners* which have a powerful impact on the *enacted* school curriculum (*instructional knowledge*). The rationale and meaningfulness of a syllabus or a curriculum, of materials, media or textbooks also affect what is learned and taught (*curriculum knowledge*). In addition, our images of meaningful learning filter how domain knowledge is represented in the curriculum and put into practice. A conceptual framework is developed to understand the complexity of knowledge transformation with regard to learning purposes and recommendations for research.

Keywords: *Curriculum; curriculum knowledge; curriculum theory; domain knowledge; educational standards; instructional knowledge; knowledge transformation; learning competencies; school knowledge; science teaching; spiral curriculum*

Introduction

The topic sounds complex. It can be focused on a key issue: *What happens to domain knowledge on its way into the school curriculum?* To deal with this question more precisely, I will specify some knowledge forces which we need to refer to in any reasoning about the knowledge transformation process. It is not only the *contextual knowledge* about *social forces* but also the school's own *educational knowledge* framework. Further, we depend on utilizing knowledge about the images of *learning* and *learners* which have a powerful impact on the *enacted* school curriculum (*instructional knowledge*). The rationale and meaningfulness of a syllabus or a curriculum, of materials, media or textbooks also affect what is learned and taught

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(*curriculum knowledge*). In addition, our images of meaningful learning and instructional quality filter how domain knowledge is represented in the curriculum and put into practice.

Beyond this, domain knowledge is context-bound. The bulk of the social corpus called school follows formal and informal rules, criteria of control and commitment, and its 'home' rationale of organizational development (Sarason, 1982; Corbett, Dawson & Firestone, 1984; Lieberman & Rosenholtz, 1987; Miles, Ekholm & Vandenberghe, 1987; Fend, 2006). Germany, Sweden, Austria, also partly Switzerland, among others, have shown that the patterns of how schools organize their development shape what is taught and learnt (Ekholm, 2004). In this regard, the school as a contextual system of practice influences the curriculum (*school knowledge*) (see Hameyer, 2004, 2006). A school which fosters cross-subject work at the upper secondary level will not only redesign the transforming process of the subject domains involved, but probably also intensify team work or a continued dialog across subjects.

A *systemic view* allows for a varied, multi-perspective look at the interplay of the forces at stake and their impact on transformation. All levels combined require *professional knowledge*, consisting of the above mentioned types of knowledge.

In this article, I will first (a) refer to the characteristics of the transformation process; (b) then characterize the professional knowledge, mirroring the various forces which shape domain knowledge on its way into school; (c) finally, I will look at some lessons for future development and research.

'I teach mathematics' or 'I am a mathematician' – this jargon is often used at grammar schools (Gymnasium) in Germany. Such teachers think they teach a subject, not a student. The same is true for teachers who studied natural sciences, but not for those teachers who studied arts. Virtually never would an arts teacher say he/she is an artist nor would a music teacher pretend to be a musician. A teacher of Latin may say he/she is a 'Lateiner' but it would be unusual. In contrast to grammar schools, these self-images are rarely ever used in primary schools. Such teachers are conceived as pedagogues or multi-talented experts for children, while a gymnasium teacher almost never uses this *educational* image for himself or herself. The language sometimes unravels tacit views of professional identity and the prestige of a subject.

Transformation Process

This exemplary facet indicates that domain knowledge in fields such as arts, linguistics, history or natural sciences is subject to the professional identities of their 'owners' and their images of the *credit value* given to 'their' domain and their subject respectively. Societal values are invested in specific knowledge domains and corresponding curriculum practices. Thus, domain knowledge cannot be placed or mirrored directly into the curriculum. A school curriculum is the result of a complex transformation process and not just a matter of sizing down quantities of domain

content; the latter model of ‘Abbilddidaktik’ presupposes a *logic of deduction* which has proved to be an error of curriculum reasoning (Meyer, 1972).

- At a glance, *transformation is an educationally focused process of domain analysis and curriculum reasoning* with the aim to construct basic patterns of subject knowledge which follows educational purposes of learning and instruction. There are many ways to transform domain knowledge, such as starting from fundamental ideas or reconstructing the domain from a cross-disciplinary perspective.
- We have to bear in mind that no transformation approach can be exclusively derived from an internal logic of the domain under study. Many forces and tacit premises come into play, e.g. psychological, pedagogical or motivational guidelines, be they explicit or not. This is why it is important to reflect domain knowledge in terms of the hidden and the explicit, the guiding aims and official tasks, the images of learning, and the ideas about the advantages of any new knowledge under consideration.

Transformation can have different faces. This is true for the product as well as for the methods of transforming knowledge. Domain knowledge can be transformed into a curriculum subject by various methods such as the following:

- reconstruct (e.g. controversial theory discourse; astounding phenomena),
- reduce (e.g. the complexity of content by fundamental ideas),
- focus (e.g. on exemplary content or findings; heuristic methods),
- integrate (e.g. by using cross-subject concepts such as *time*),
- reconceptualize (e.g. by educational ideas such as child-centeredness),
- select (e.g. by using exemplary value criteria, *pars pro toto*),
- simplify (e.g. by looking for basics that are easy to understand).

Reduction is an often used method of transformation. It is frequently based on fundamental ideas such as *evolution* in biology, *diversity* in social sciences, or the concept of *energy transformation* in physics. The Sputnik shock in the US caused various efforts to improve learning by using basic concepts and fundamental ideas for curriculum renewal. Fundamental ideas like transformation, interaction or a conceptual systems approach in science education were expected to serve as cognitive anchors in a spiral curriculum (Bruner, 1960). They were tools for scientists on their expedition to find the secret of a core curriculum. This curriculum was then to be organized in a spiral way so that students could repeatedly go back to the backbone of a few basic ideas in order to elaborate them on a progressively higher level of understanding.

Professional Knowledge

Domain knowledge can be transformed in terms of *educational* purposes if we are using what we know about the school as an organization where the curriculum is

located. Both, domain *and* school knowledge, need to be complemented by what we know about meaningful learning and good instruction. For this we use the term *instructional knowledge* which, in turn, needs to be related to what we know about the curriculum design and its levels of representation (*curriculum knowledge*). The curriculum design and its rationale shape the subject domain and how it is educationally organized. Figure 1 shows that the types of knowledge as a linked system of *professional knowledge*.

Two premises support the need for the model shown in Figure 1: (a) School and curriculum knowledge can, by their complementary nature, clarify the conditions for transforming domain knowledge into effective, educationally grounded patterns of curriculum practice which, in turn, gains from what we know about the learner and the teaching. (b) Knowledge about meaningful, motivated learning has, so far, been exploited only 10 or 15 percent. If we use more of this knowledge, the curriculum design can be more effective and realistic. The state of the art is not

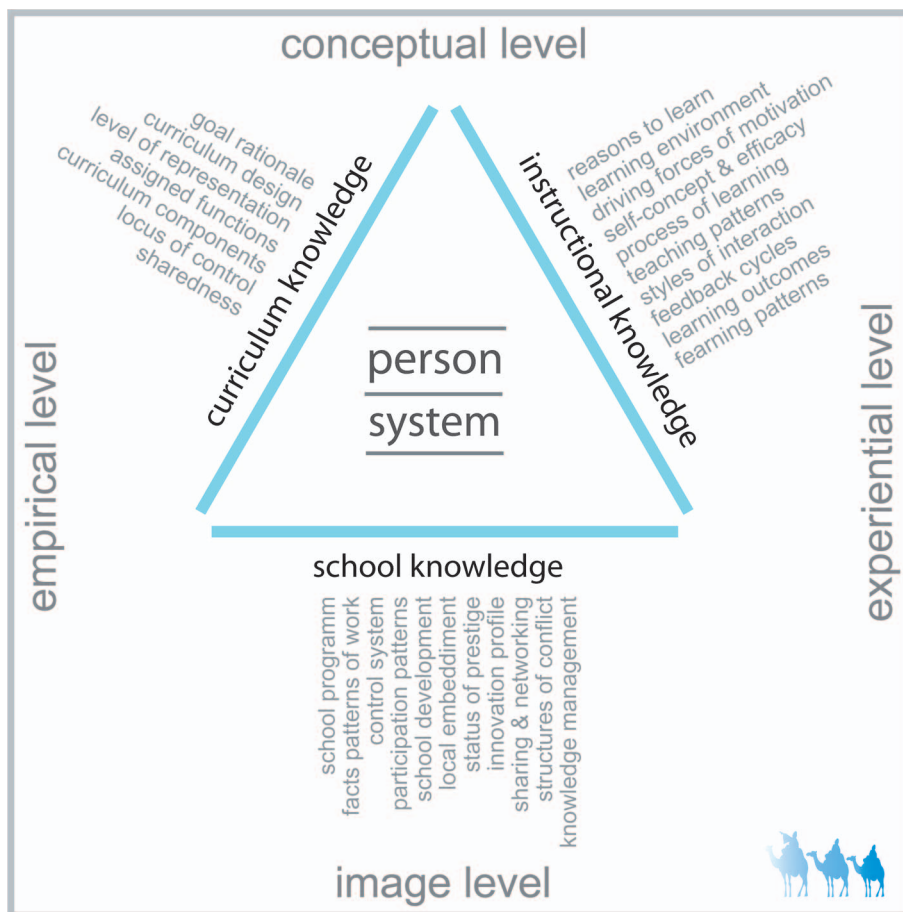


Figure 1. Components of professional knowledge (Hameyer, 2007)

sufficiently used. School knowledge, too, is more elaborated, although not used in systematic ways.

In a similar way to the conception of Banks, Leach & Moon (1999), I also refer to school knowledge in a model of transforming domain knowledge (figure 2), albeit in a slightly different sense. School knowledge comprises structural features of a school, its patterns of work, and its process of development. Instructional knowledge encompasses what Moon (2007) says about subject and pedagogic knowledge, including what we know about the quality of learning and instruction. Here again, many more findings and experiences are available than used. School education and its researchers are not world champions when it comes to knowledge use. This is not only because retrieval systems are lacking, but also because we have not established routines and standards to back proposals or ideas with what we already know. Figure 2 depicts the transformation model in a simplified way.

The discourse about the educational value of domain knowledge requires arguments about what should be taught in schools and for what purposes. Ralph Tyler (1971) formulated a three-fold rationale more than half a century ago which allows for a kind of educational triangulation of school knowledge: School, Society, and the Learner. Later, theories and studies of educational reasoning and legitimation showed in equivalent ways that there is no deductive way from a domain down or up to educational purposes. Instead, it is much more a matter of interdependence and systemic relating.

Similarly, if somebody ‘teaches a subject’, he or she needs a pattern of reasoning about why some issues are selected while others are not. On top of that, there is a need to show the sense or educational purpose of what can be learned by students when they deal with subject matter content. Currently, we have a substantial debate in Germany on the learning competencies that students should be able to build within the subjects in a school, in addition to the more subject-based issues or fundamental ideas.

These preliminary remarks may show that domain knowledge always requires a transformation process (Figure 2) into the world of education. We cannot just reduce domain content and presume that less of it is easier and adapt it according to the age of the students. Transformation is much more. It yields a reconstructive view at domain knowledge from an educational, curriculum and school knowledge perspective.

Domain Knowledge

A domain is not easy to define. Some domains are represented and codified as scientific disciplines, others are not. Arts also belong to scientific communities although they are not exhaustingly codified by the world of scientific criteria similar to other domains, such as technology or sports. Health education or ecologically based subject matters both refer to multitudinous disciplines *and* also codes of the practical (Schwab, 1978).

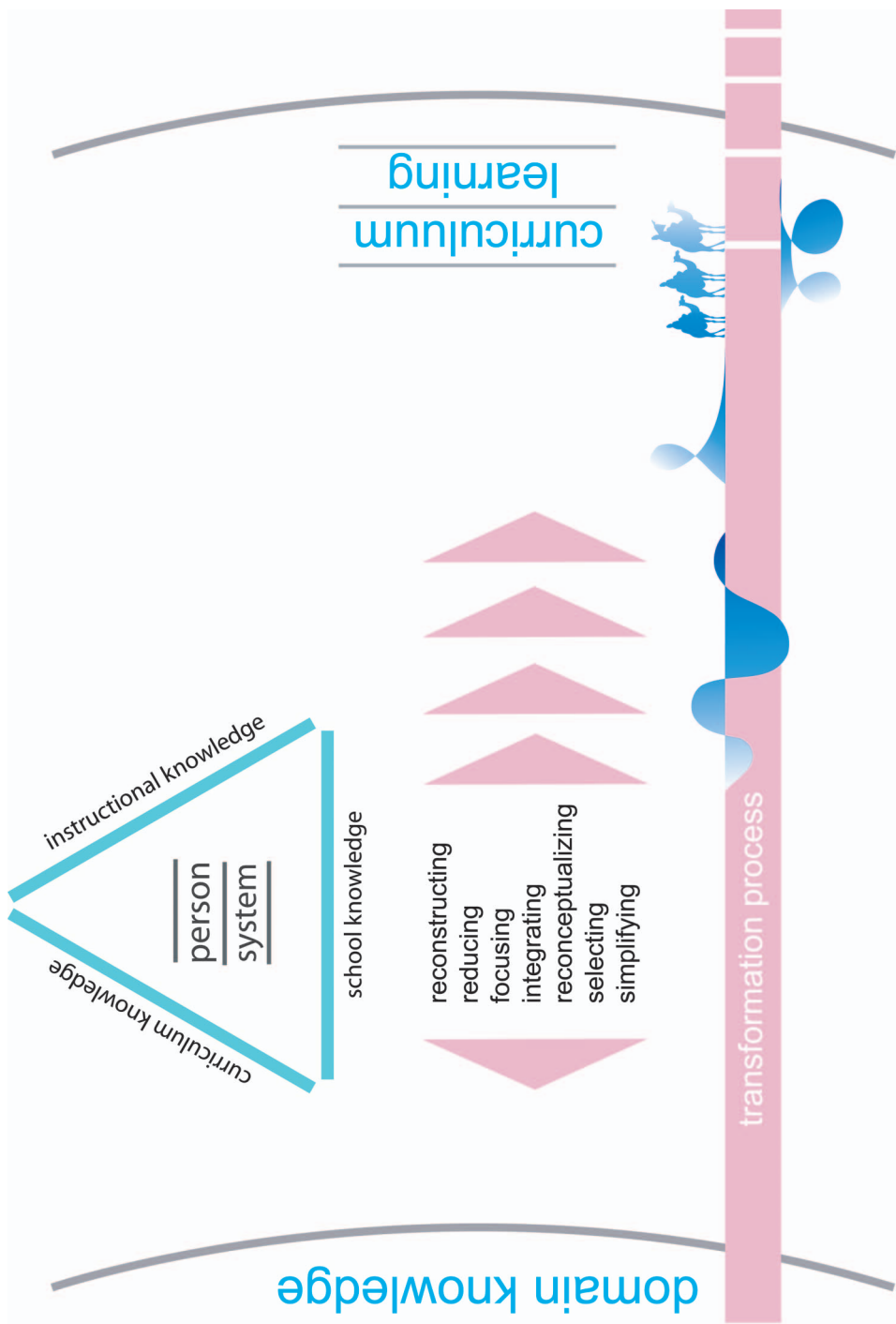


Figure 2. Process of transforming domain knowledge (Hameyer 2007)

I conceive of a knowledge domain as a well-defined, classified body of knowledge based on epistemological paradigms and systems of discourse about its validity and value. A knowledge domain is at the same time considered a referential unit which is, by different methodologies, transformed into components or entities of a subject matter domain. Examples of a subject matter domain are energy as a guiding concept in physics teaching or identity in social science courses. According to energy, it indicates a discipline-based domain which has to be transformed in physics teaching according to 'educational' aims or 'basic educational ideas'. This process is never only a matter of quantity reduction or mirroring the most important. I have shown earlier that it is much more a matter of focused, educationally guided reasoning in view of what we know about the learner, the school, the instruction and the curriculum.

Instructional Knowledge

Conditions for learning and instruction have long been investigated. Several handbooks summarize the state of the art. More than 30 years ago Lundgren (1972) gave rise to a theory that explained the framing forces in the curriculum and teaching process. This is not the place to summarize selected findings, as the array of theories and studies is too broad. We can, however, indicate which research domains are very important for our understanding of selected framing forces which have an impact on the domain knowledge transformation process.

Motivation. Why do students learn in specific settings in contrast to others? The empirical knowledge has made progress, and we urgently need to screen major findings and learn about their impact on transforming domain knowledge in a way that facilitates meaningful learning. I will come back to this point when talking about the representational levels of curriculum.

Theories of learning. Festinger (1976) and Berlyne (1974 [1960]) found that arousal and curiosity play an important role in the readiness to learn. A cognitive conflict between one's own knowledge or perception on the one hand and a new situation or task on the other, promotes learning if the distance is neither too big nor too small. The complete theory is, of course far more complex and better defined. So far too little attention has been paid to its value for deliberating about what kind of domain knowledge should be organized and represented in a way which makes meaningful learning more likely to occur. In addition, we have to consider that *subject* content of students as well as of teachers takes a major role in shaping what goes on in classrooms and the learning process. Ametller, Leach & Scott (2007, in this issue) have carefully reviewed and studied the subject component in science and mathematics education.

Astounding phenomena. Wagenschein, a German scholar, published a well-known book called *Verstehen lehren* (1970) wherein he refers to a Socratic method of reasoning about astounding phenomena in the daily life of students or in the rise of

theories. Theories, according to Wagenschein, resulted very often - at least in the domain of natural sciences - from controversial debates and fights among the opponents, mostly theorists who had different opinions about the cogency of their own statements. Wagenschein makes the genesis of theories accessible to the students and helps them learn from these controversies by understanding the core explanatory ideas rather than pursuing a more declarative knowledge approach. Other scholars expanded this approach for different subjects although the basic idea has not been as widespread as its value merits. The category *Verstehen* is a traditional term in German *Bildungstheorie* which, itself in turn, encourages teachers to focus instruction on patterns that support meaningful learning and basic comprehension of phenomena or fundamental ideas. This tradition has a value in itself and should not be rejected because it does not follow an empirical methodology. A lot more fields could and should be mentioned. I stop here because I merely wanted to illustrate for exemplary purposes that there is a strong need to make use of what we know about learning and the learner, as well as about teaching and student-teacher-interaction.

School Knowledge

Transforming a selected knowledge domain to suit a school subject is not only a matter of curriculum deliberation but also a matter of an organizational analysis. A curriculum is contextual grounded. It has to be reflected in view of its various functions in a specific organization (Hameyer, 1991; Hameyer et al., 1995). Herewith *framing factors* such as the following come into play:

- quality standards
- working patterns
- system of control
- commitment profile
- lesson time limits
- teacher identity
- gratification schemes
- educational program in place
- policy of the school
- sharedness of focused aims

I will refer to two examples to illustrate some of the framing forces inside schools and discuss their impact on the intended and enacted curriculum. One example is in local scope, another is of regional or even national scope. The first shows how a competence-based science curriculum of a grammar school was shaped by internal framing forces at the primary level, the national scope case is about a framework for general science education (Sachunterricht) on the primary level.

Case 1 – Grammar school Bünde, Germany

Bünde, a small city nearby Cologne, has a grammar school which integrates science teaching through grades 5 and 6 (11 to 12 year old children), which is different from

schools in other locations. Only in later grades do the classical science subjects occur in the timetable. The school not only rebuilt the subject sequentially, but also converted its core ideas to an educationally defined curriculum which was from its outset supported by changes in the contextual system of practice (e.g. teacher allocation, timetable, team building, making parents familiar with the Bünde-model, see Langer et al., 2007).

In addition, they have installed an advisory feedback system for all the students which provides a 20–30 minute counseling session between the teacher and the student. The teachers are trained in this process, which is implemented for all ages in the school. Students use this feedback system frequently, usually two to four times a year. They document their learnings and works in a portfolio to which they refer to in these feedback discussions. During these discussions they are encouraged to show what they have mastered and where they did not achieve their learning goals. Mostly at the end of the feedback session, they express the need for further learning and support. This advisory system creates rich knowledge about learning difficulties and the necessity to reshape the curriculum, at least partly. At the same time, feedback is guaranteed as a constituent part of learning and instruction and is thus incorporated into the local school system. The model is not just the idea of somebody who happens to like feedback, but resulted from school knowledge, i.e. experiences with continued, embedded feedback at other schools, knowledge about learning effectiveness, self-efficacy, appreciative methods for instruction and a clarity about how to implement self-guided learning in science teaching.

If Bünde had not reflected on the school system requirements and the potential driving forces for new ways of teaching according to a competency-based curriculum, the new curriculum could have been seen as weak in its impact, probably considered as an imposed menace to the individual teacher. It then would have ended up in the desert. However, Bünde has *used* and *produced* school knowledge on the way to success. This approach integrated curriculum and school development work from the outset. A stepwise process of implementation and reflected improvement was supported by curriculum-based staff development. This, in turn, implies that the domain knowledge transformation process was mainly under the guidance of the school. For better understanding of the contextual background, it is important to realise that schools in Germany are under the control of the 16 ‘Bundesländer’ (state). The schools are given some degree of autonomy within the policy framework of the ‘Bundesland’ where they are located, which does not imply that they have to meet central standards and the state-level syllabus. This may be regarded as semi-centralized, although some argue that Germany has a highly autonomous school system because each Bundesland decides its own policies for schools and the school curriculum.

Case 2 – Curriculum Framework for Science Teaching – Perspektivrahmen Sachunterricht

At the turn of the century Helmut Schreier, professor of education and science at Hamburg University, took the initiative to elaborate a curriculum framework for

science teaching in primary schools in Germany. This idea came from the view of a need to secure more space for science issues in the primary curriculum in all 16 states. At the same time we thought it necessary to strengthen the core ideas of science issues in the curriculum and, at the same time, to provide clarity about what the different realms of science could be. Different from the tradition of curriculum-making, this was a system-wide process of curriculum reasoning with the aim to involve outstanding experts from universities, teacher education and educational science to formulate the framework. Through combined efforts various authorities and decision-makers were included in this process which was supported and ‘owned’ by the German Association for ‘Sachunterricht’, including science teaching at the primary level. The implementation process is still continuing with many needs for readjustment and adaptation.

Within this adaption process, domain knowledge was transformed in many ways, based on the premise that it should motivate students to be curious about natural science issues, to build a core of competencies so that students can better understand and explore the world of nature, explain astounding phenomena, discuss cultural diversity, reconstruct technological inventions and progress from a global perspective on history, or reconstruct reality from interdisciplinary perspectives.

It is important to stress that this framework had to take in knowledge about the enacted curriculum or syllabi in the states, the contextual differences between schools and state policies. Also, it had to consider knowledge about sustained development in the schools and their curriculum. At the same time, a new concept – such as the framework – had to be communicated, discussed, adapted and made familiar to a large number of stakeholders and, of course, teachers. Without using established school knowledge we would have certainly fallen into the traps of the system, although admittedly we sometimes did so nevertheless. . . .

Curriculum Knowledge

Curriculum design is not just a matter of creative thoughts about its rationale and design. For decades research has produced a body of knowledge about its use and implementation, its design and patterns of control, levels of representation, its scope and influence on teaching practice. Teachers and curriculum designers should make reflective use of the state of the art to avoid the risk of reinventing the wheel and ending up in deserts. This is particularly so for those who transform domain knowledge, be they teachers, experts, syllabus workers, in-service trainers or stakeholders on the policy level. I have seen so many efforts of curriculum renewal where curriculum renewal was mastered only by opinion leaders, incidental cleverness and a highly normative rhetoric of practicality.

Curriculum Representation

A curriculum has different faces. It can be codified or enacted. Sometimes it is blended by a tacit set of personal or public norms. It can be specified in tests or

standards, in approved textbooks or self-made teaching materials, in a guideline such as the Norwegian curriculum (Table 1), or it can grow out of local school programmes and regional development plans.

Table 1. A Norwegian curriculum guideline.

The man searching for a meaning
The creative man
The working man
The generally educated man
Man as a fellow human being
The environmentally-aware man
The integrated man

Goodlad (1969) reflected the phenomenology of a curriculum; his concept was later taken up by Jan van den Akker (1988). I will discuss this idea from a more systemic view, which reflects the representational levels in their interplay in various ways. This is needed if we want to understand the transformation of domain knowledge by curriculum reasoning, policy-making and its enactment in practice.

The perspective of representation includes the *invisible*. An invisible curriculum is tacit or hidden. It is rooted in the minds of every teacher, policy-maker, parent, or student when they think about what should be learned at school. *Tacit images* shape not only what people think but also what they do and – at the same time – what they dislike (e.g. Morgan, 1986). According to this view of the representational curriculum, we can discern the following ‘faces’ or levels:

- the codified curriculum
- the perceived curriculum
- the intended curriculum
- the enacted curriculum
- the experienced curriculum
- the tested curriculum
- the hidden curriculum

The interplay of these levels helps us to understand what happens during the transformation process of domain knowledge on its way from outside into the school and its local enactment. A teacher who likes knowledge-based sequential learning within his subject perceives and interprets the curriculum probably differently from one who favors a daily-life-focused, exemplary design of instruction. Both will enact the compulsory curriculum in other ways according to their own aims which may be underpinned by tacit purposes.

A tested curriculum selects by nature something that is considered to be *pars pro toto*. Tests are norm-referenced; students are compared to others inside or outside the school. Test results are given institutional power which can be used for accountability goals and are individual placement decisions. Schools

and teachers who are committed to these functions will value this tested curriculum approach in different ways from those who think that tests are counterproductive for local efforts of a school to create its own internal standards for student achievement and practice (Hameyer, 2007). With this in mind, these latter schools rely on the concept of autonomy as promised and granted by parliaments.

Currently, schools in Germany and also partly in other countries (Sweden, Austria, some Swiss cantons) go through a burdensome paradox of double-bindedness: on the one hand, they have to meet the *power* of controlled expectation represented in an externally defined, standard-based test curriculum; on the other hand, they are expected to *empower* themselves professionally according to their own educational focus and local conditions of work.

Centrally controlled power forces are combined with regional control systems. These 'new public accountability and control patterns' each enter the school system through various measures: comparative achievement tests across all schools and all 16 'Länder', even though each 'Land' is, by law, *independently* responsible for its public schools. External evaluation schemes are being put into place, and new syllabi are being introduced. Monitoring systems are currently being designed and installed by state-level authorities. Internal quality management efforts are demanded from each school.

Such state-level measures are blended with external patterns to 'help' schools improve and aid them in using support systems. Schools are expected to standardize their work so that 'flexibility across schools and Europe' is more likely to occur. Consequently, schools have to show what they are doing. They have to prove the accountability of their work, yet – at the same time – there is a given need to individualize learning opportunities and instruction.

The various, mostly state-driven forces behind the school curriculum give rise to a growing suspicion of many teachers, and to a loss of *confidence in the system* (Hameyer, 2006) because the politics of school autonomy which started nearly two decades ago are substantially contaminated by a powerful growth of external forces bearing down on the school. This is also true for the domain knowledge as transformed in the curriculum.

Most professional schools cope with these developments as they know how to cope with external measures in a more or less sovereign way. They master external requirements in strategic and creative ways, though some suffer for various reasons, such as bad working conditions. They are the losers and there are already programmes to work with these 'failing' schools. It is evident that the growth of the external power on schools increases the probability that the schools will differ much stronger in terms of quality than they did before; in other words: the 'new accountability management pattern' increases the differences *between* schools. In Germany we call this divide a 'Schereneffekt' which does not only apply to the quality of schools but also to the discrepancies between the levels of curriculum representation shown above.

Concluding Remarks

Using knowledge more systematically is required during the transformation process, and also in other fields of education. We need knowledge not only to create or maintain a diversity of options to act, but also to reduce complexity. The more we know about a focused idea or task, the more it is likely that we can choose among alternatives, that we can play with ideas and value them, that we can feel stimulated by new insights, and that we can make solutions sound and ripe for practice. Mismatches and failures in the complex world of education are mostly expensive in the long run. Additionally, they increase mistrust and disappointment. This leads to a waste of energy, one of the seldom mentioned side effects. To this end I will consider some requirements of research and professional knowledge.

Research Needs

It is necessary to specify the core questions of transformation problems in time and to do so in a knowledge-based way, allowing for a sound deliberation of the school curriculum. Even more so should we mandate ourselves to clarify what is known and what is *not*.

Statement 1

A key issue for research is related to the students and their patterns to work with overloaded, over-framed curriculum units. Stephens, Wineburg, Herrenkohl & Bell (2005) argue that a comparative understanding of school subjects represents ‘a promising path for conceptualizing research on children, schooling, and thinking by raising questions about children’s understandings that have hitherto gone unasked’ (p. 2). We rack our brains about tacit strategies students use to make sense of knowledge from curriculum materials or textbooks which they experience through a document, a task, or orally by the teacher. Although scholars in the domain of neurological research seem to shed more light on this, so far our knowledge about the mechanisms of how students transform instructionally exposed knowledge in senseful, retained ways is still rather poor. It is not only a matter of how students and materials interact but also a matter of text quality (clarity, design, specific subject-based features of the text, degree of inclusion and explicitness, language use, logical structure, quantity of concepts used, and other, see Popp, 2007). Thus, a crucial research field is emerging.¹

One of the basic issues - from my point of view - is reflected by the following question:

What happens to a specific domain when it is exposed to students, be it via textbooks, curriculum units, presentation by the teacher or other ways?

Comparatively urgent is a study of what the students retain in the end, not to mention what they transform, store and forget. A good pathway to investigate this study is shown by Anderson & Hounsell (2007, in this issue), particularly when they refer to the intricate connection between the form and content of knowledge.

Statement 2

We need interdisciplinary projects to explore this field with good resources and experts from different research fields. They may locate these studies in several subject domains, because we assume that quite different patterns of teaching and knowledge exposition as well as different patterns of transformation by the students are in place. Susanne Popp has pointed out the need for elaboration of this research domain in specific, partly in subject-related ways, and she is starting a combined basic and applied research project. The study will focus on patterns of understanding textbooks for history teaching, including other domains as well in order to learn by systematic comparison. She will investigate, among other issues, the *sense-making process* of students when they read textbooks or use equivalent materials.

Statement 3

Last but not least, we need an open system of knowledge accessibility and use. The worlds of business and law, communication and medicine relate their decisions quite frequently to scientific and experiential knowledge (e.g. by using expert panels, journals, information services, internet communities, networks, knowledge retrieval systems, other resources). In this area, the world of education is clearly lacking. I will therefore make some concluding remarks in this direction.

Professional Competencies

For teacher education and staff development methods and solutions should be created to draw upon curriculum knowledge in a more powerful, task-oriented, and continued way. This requires serious efforts about:

- the development and implementation of teacher competency profiles including the curriculum domain (KMK, 2004). Among other professional daily tasks, teachers should be knowledgeable about the *comprehensibility of various sorts of texts in textbooks, other learning materials, and written hands-on products* provided for students. They should also be qualified to use basic research findings about text features when they *produce* materials for the learners (Popp, 2007);
- creating knowledge exchange networks which link universities, schools and support systems along focused tasks;

- producing an *international curriculum knowledge newsletter* about major research findings and projects, about theories and their impact, about curriculum-related activities, and other issues of concern;
- raising funds for a *European programme* to start a series of comparative curriculum research and development projects which focus on research issues of high priority and practical impact;
- linking scientific and experiential curriculum knowledge by joint efforts (cross-country projects, cross-subject workshops or conferences with specific tasks, take-off events, review exercises, state-of-the-art reports, internet-based knowledge communities, etc.);
- editing a series of curriculum booklets which strive for continued communication about curriculum knowledge use and the exchange of comparatively based information on what is going on in other countries.

Note

1. It is hence interesting to note that Susanne Popp is preparing an interdisciplinary research program at Augsburg University together with other disciplines and research places.

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